Longitudinal Polarization in RHIC

Consider method of achieving longitudinal polarization at the IP's with no rotators and two snakes in each ring.

- Inject vertically polarized protons with both snakes on.
  $E \sim 24.3$ GeV ($G\gamma \sim 46.5$)
- Accelerate beams to 102.53 GeV ($G\gamma = 195$)
- Turn off one snake in each ring: polarization $\Rightarrow$ horizontal plane.
  (Long. Pol. at IR's.)

Note: A table of other energies which can be used for longitudinal polarization at all IP's may be found at
http://www.rhichome.bnl.gov/RHIC/Spin/spinfigs/100GeV-1snake.html

Polariation with a Single Snake On

At $E = 102.05$ GeV:

$G\gamma = 195 = 3 \times 65$

Helicity alternates at IP's

For $\frac{\Delta p}{p} = \pm 0.001$

STAR/BRAHMS:

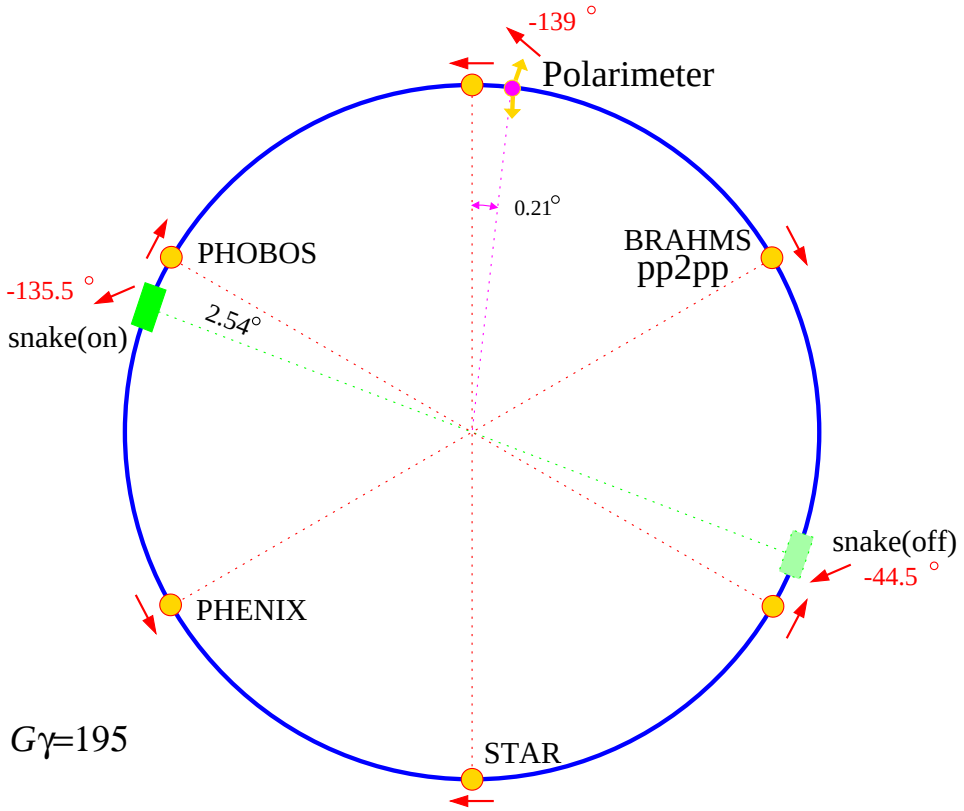
$$32.5 \times \frac{\Delta p}{p} \times 360^\circ = \pm 12^\circ \ [0.98]$$

PHENIX:

$$65 \times \frac{\Delta p}{p} \times 360^\circ = \pm 23^\circ \ [0.92]$$

PHOBOS:

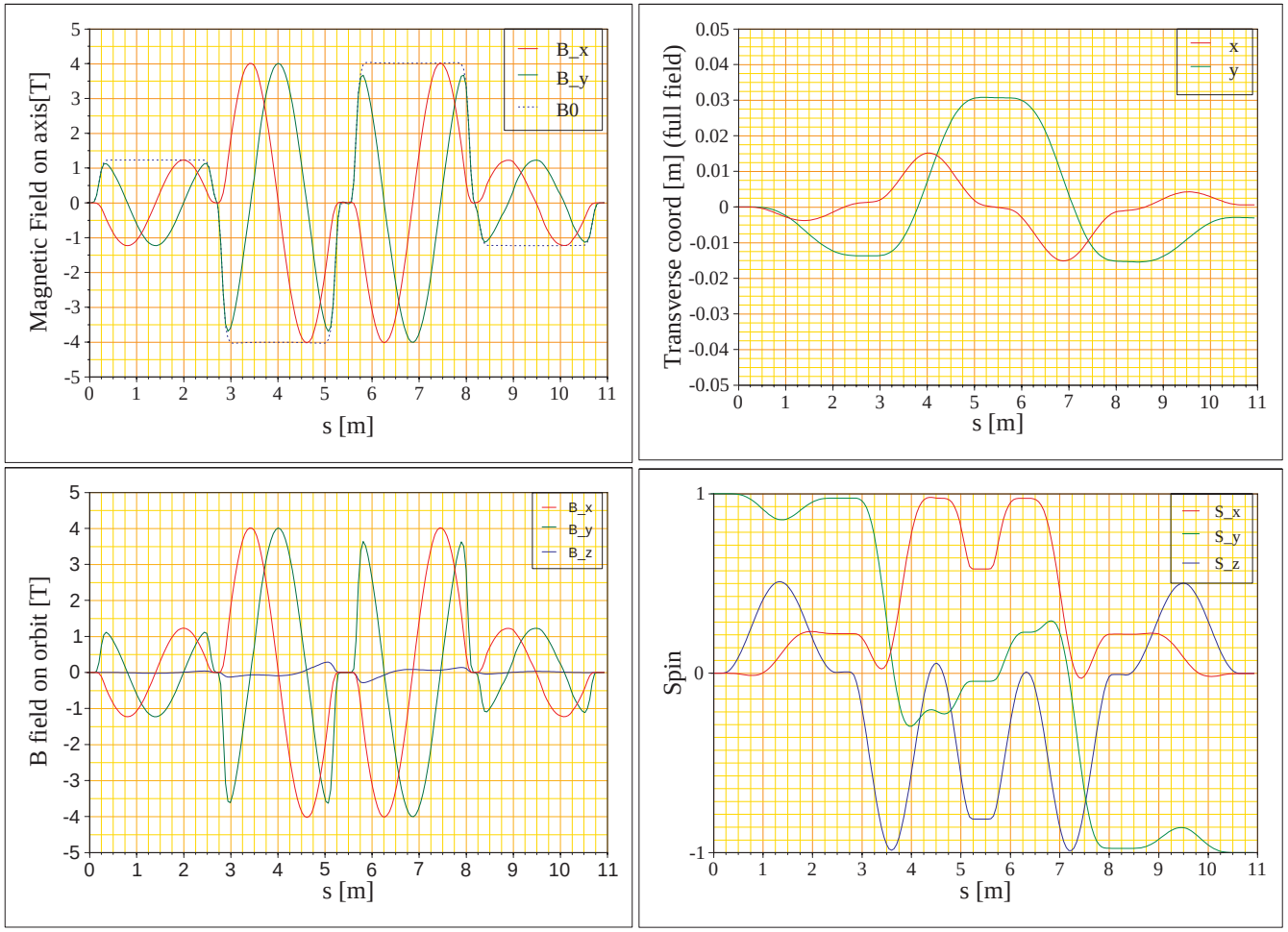
$$97.5 \times \frac{\Delta p}{p} \times 360^\circ = \pm 35^\circ \ [0.82]$$



Polarization in Blue Ring with One Snake On

Note:Opp. snake⇒ PHOBOS:±0°; PHENIX:±12°; STAR/BRAHMS: ±23°.

1st Snake with Measured Fields



SNAKE: bi9-snk7	I_in [A]	92.00
	I_out [A]	321.00
	G*gamma	46.50

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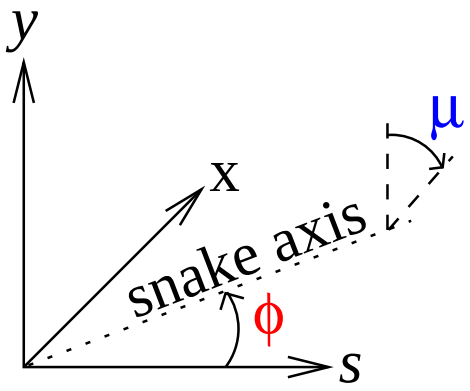
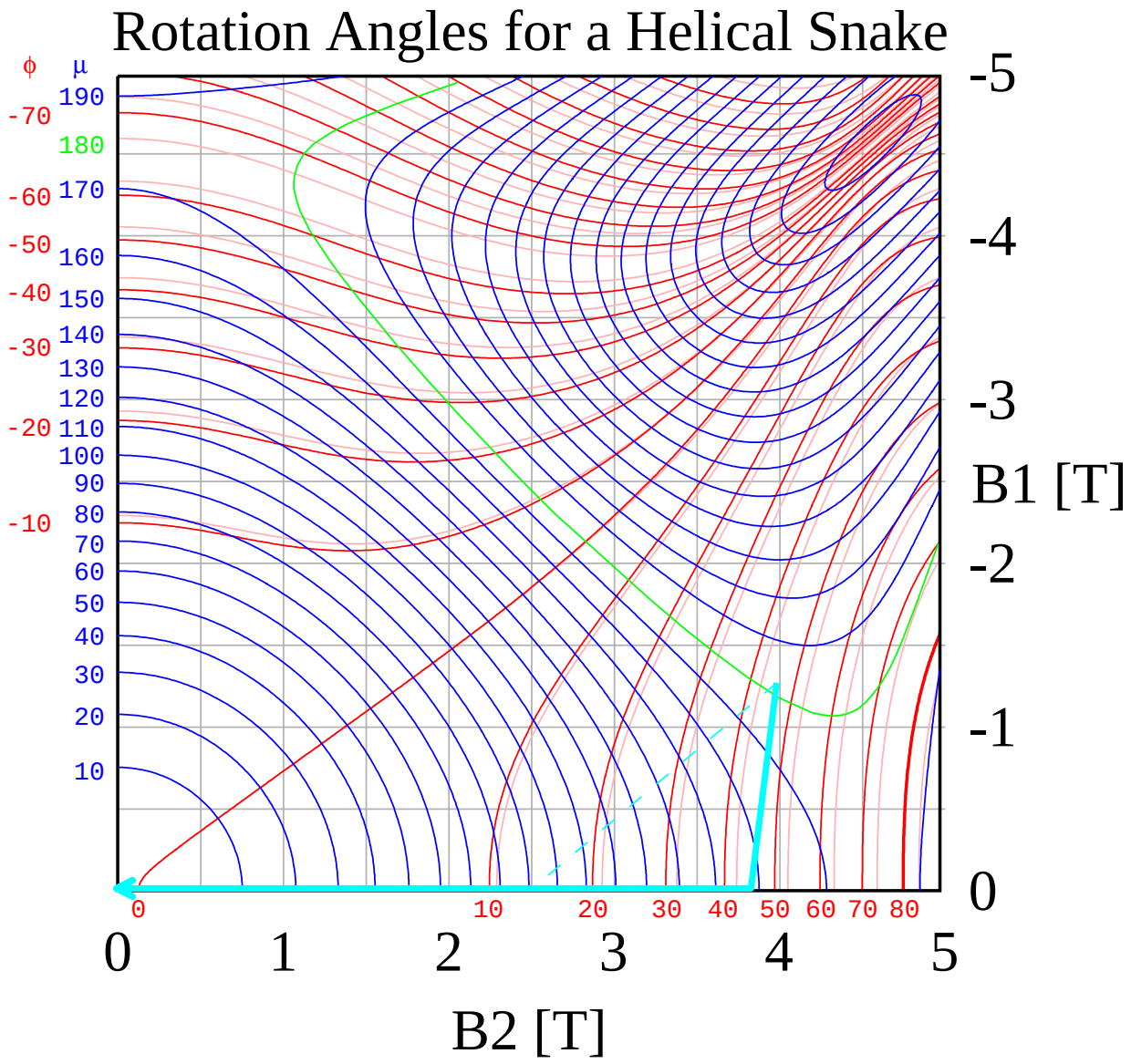


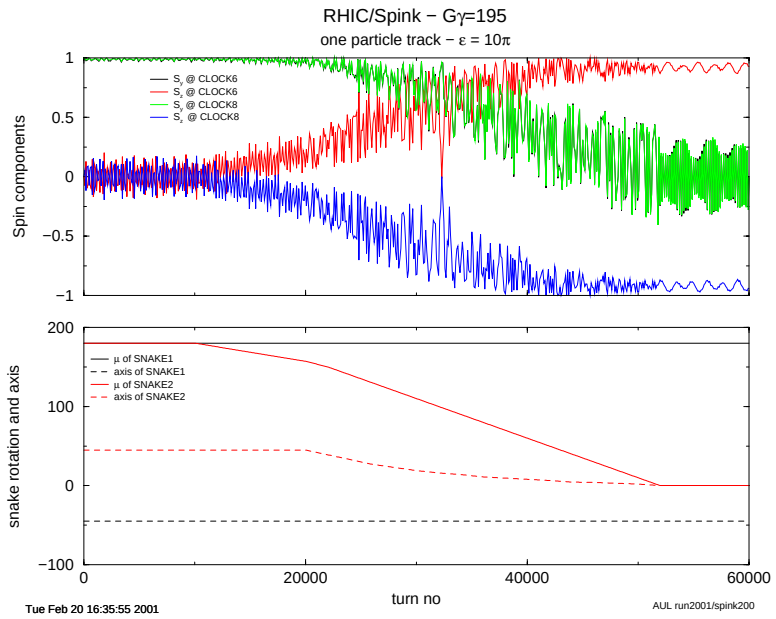
The rotation axis of the snake is ϕ, and μ is the rotation angle.

Note that the ϕ contours shift slightly from injection (red) at 25 GeV to storage (pink) at 250 GeV.

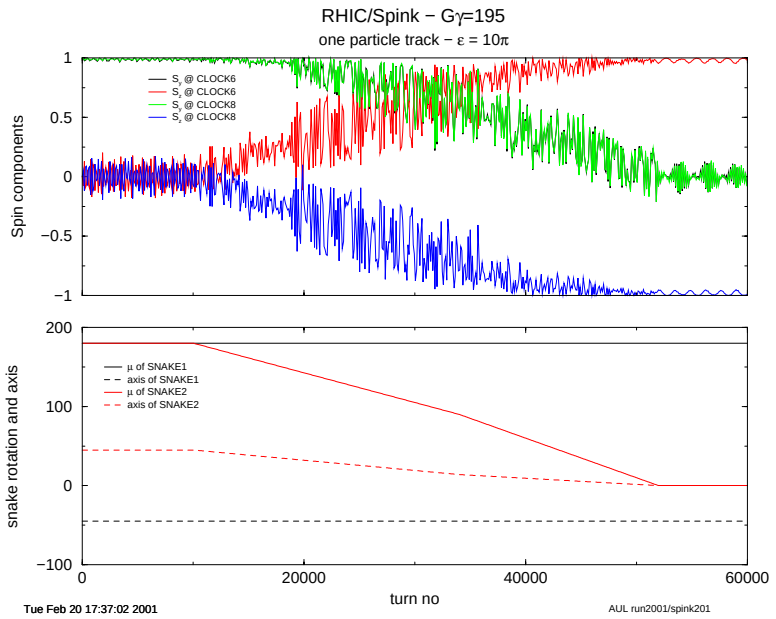


Preliminary Single Particle Tracking

Turning off one snake at fixed energy



Following solid cyan curve on p. 7.



Following dashed cyan curve on p. 7.

Note: Here the snake was turned off in less than 1 second. In the actual case, it will take 5 to 10 minutes to turn off the snake.